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MEMORANDUM

DATE: October 18, 2019

TO: Joseph Miller, SCS Engineers

FROM: J.T. Stephens, Associate

SUBJECT: Noise and Vibration Memorandum for the Eastlake Sanitary Landfill Expansion Project

The purpose of this Noise and Vibration Memorandum is to describe and document potential noise and vibration impacts associated with the implementation of the proposed Eastlake Sanitary Landfill Expansion Project (project) at 16015 Davis Avenue in Lake County, California. This technical information is provided for project review under the California Environmental Quality Act (CEQA) and other pertinent regulations.

PROJECT DESCRIPTION

The Eastlake Sanitary Landfill is owned, operated, and managed by the County of Lake (County). The permitted landfill boundary encompasses approximately 80 acres (ac). The current permitted landfill footprint is approximately 35 ac. The County also owns approximately an additional 100 ac northeast and south of the landfill property. These additional parcels are not included in the currently permitted facility boundaries but have been identified as areas for possible landfill expansion.

On-site facilities include a scale house/weigh station, a liquids surface impoundment, and a landfill gas (LFG) collection system with a blower/flare station. The landfill is accessible via the local streets of Davis Street, 40th Street, Phillips Avenue, and Moss Avenue.

It is estimated that the remaining permitted airspace capacity at the landfill will be exhausted as soon as early year 2024. CEQA review, permitting, final design, and construction for the proposed project must be completed by 2023 year end. The proposed landfill expansion would provide long-term disposal capacity and accommodate public infrastructure needs. No significant changes in day-to-day site operations would be anticipated as a result. Figures 1 and 2 (all figures attached) show the project location and site plan, respectively. The Eastlake Sanitary Landfill is the primary disposal facility for nonhazardous municipal solid wastes (MSW) generated within Lake County. Under Solid Waste Facility Permit No. 17-AA-001 (SFWP No. 17-11-001), current site operations are governed by the following:

- Hours of Operation: 7 days per week (except holidays), 7:30 a.m. to 3:00 p.m.
- Average Daily Intake: 200 tons (equivalent to approximately 70,000 tons per year)
- Maximum Daily Vehicles: 300 vehicles

Lake County residents and businesses currently generate approximately 40,000 to 50,000 tons of MSW per year requiring disposal at the Eastlake Sanitary Landfill. These totals exclude wildfire debris that has been disposed at the landfill over the period of 2015 through 2018 under waivers allowing additional intake and associated traffic, as granted by the oversight agencies. Over the course of a year, the average daily traffic count is approximately 175 vehicles. This includes deliveries by franchised waste haulers (in packer trucks, roll-off bins, and transfer truck/trailers) and by self-haul customers (the general public, landscapers, and other trades).

The current average daily MSW intake and vehicles are generally well below existing permit allowances. Based on MSW intake information from the County, as well as a one-day survey of the Eastlake Sanitary Landfill, 664.73 tons of MSW were delivered to the landfill on June 26, 2019, by 248 vehicles (109 passenger vehicles and 139 large trucks). Although that one-day intake is approximately three times more than the average daily intake of 200 tons, the surveyed number of vehicles is within the maximum-allowable 300 daily vehicles.

The proposed project would have the same hours of operation as the existing landfill. According to the County, the existing (2019) intake of MSW is approximately 45,600 tons per year, while the anticipated future (2050) intake of MSW is 67,900 tons per year. Therefore, the project would include the intake of an additional 22,300 tons per year of MSW, or approximately 63 additional tons per day of MSW, on site.

Landfill expansion will take place in phases, as shown in Figure 3, with discrete cells or modules to be constructed every 4 to 9 years. These construction projects will be concurrent with, but independent of day-to-day landfill operations. Four construction phases are envisioned. Phases 1 through 3 will require excavations to reach required cell base grades, stockpiling of excavated soils, and installation of landfill containment systems (soil/geosynthetic base liners and leachate collection and recovery systems). Phase 4 will entail waste filling over previously constructed, lined cells. Heavy equipment use will primarily be a function of soil excavation quantities, haul distances to soil stockpile locations, and scheduling constraints for a typical northern California construction season (mid-April through mid-October). Based on these criteria as presented in the Estimated Heavy Equipment Use Memorandum[1], Phase 2 of the landfill expansion will be the most intensive with respect to heavy equipment and staffing needs. The total duration of earthwork construction activities are expected to last between 3 and 4 months.

TECHNICAL BACKGROUND

The following provides an overview of the characteristics of sound and the regulatory framework that applies to the generation of project-related noise in the vicinity of the project site.

Characteristics of Sound

Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation,

[1] SCS Engineers. 2019. *Eastlake Sanitary Landfill – Estimated Heavy Equipment Use for New Cell Construction in Landfill Expansion Areas.* September.

or sleep.
Several noise measurement scales exist that are used to describe noise in a particular location. A decibel is a unit of measurement that indicates the relative intensity of a sound. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels (dB) represents a tenfold increase in acoustic energy, while 20 dB is 100 times more intense, and 30 dB is 1,000 times more intense. Each 10 dB increase in sound level is perceived as approximately a doubling of loudness; similarly, each 10 dB decrease in sound level is perceived as half as loud.

A-weighted decibels (dBA) are an expression of the relative loudness of sounds in air as perceived by the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear's de-emphasis of these frequencies. Unlike linear units (e.g., inches or pounds), decibels are measured on a logarithmic scale representing points on a sharply rising curve.

As noise spreads from a source, it loses energy; therefore, the farther away the noise receiver is from the noise source, the lower the perceived noise level would be. Geometric spreading causes the sound level to attenuate or be reduced, resulting in a 6 dB reduction in the noise level for each doubling of distance from a single point source of noise to the noise-sensitive receptor of concern.

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. The equivalent continuous sound level (Leq) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the Leq, the Community Noise Equivalent Level (CNEL), and the day-night average level (Ldn) based on A-weighted decibels. CNEL is the time-varying noise over a 24 hour period, with a 5 dBA weighting factor applied to the hourly Leq for noise occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours) and a 10 dBA weighting factor applied to noise occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). Ldn is similar to the CNEL scale, but without the adjustment for events occurring during the evening relaxation hours. CNEL and Ldn are within 1 dBA of each other and are normally interchangeable. The City uses the CNEL noise scale for long-term noise impact assessment.

Other noise rating scales of importance when assessing the annoyance factor include the maximum instantaneous noise level (L_{max}), which is the highest exponential time-averaged sound level that occurs during a stated time period. L_{max} is often used together with a percentage factor, also called a usage factor, to determine the noise level created by a source or piece of equipment over a period of time. The noise environments discussed in this analysis for short-term noise levels rely mainly on the average noise level occurring for a period of one (1) hour denoted by the term L_{eq}.

Characteristics of Vibration

Vibration refers to ground-borne noise and perceptible motion. Ground-borne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem where the motion may be discernible, but there is less adverse reaction without the effects associated with the shaking of a building. Vibration energy propagates from a source through intervening soil and rock layers to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the

remainder of the structure. Building vibration may be perceived by occupants as motion of building surfaces, the rattling of items on shelves or hanging on walls, or a low-frequency rumbling noise, otherwise referred to as ground-borne noise. Typically, sources that have the potential to generate ground-borne noise are likely to produce airborne noise impacts that mask the radiated ground-borne noise. The rumbling noise is caused by the vibrating walls, floors, and ceilings radiating sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 dB or less. This is an order of magnitude below the damage threshold for normal buildings.

Typical sources of ground-borne vibration are construction activities (e.g., blasting, pile driving, and operating heavy-duty earthmoving equipment) and occasional traffic on rough roads. Problems with ground-borne vibration and noise from these sources are usually localized to areas within approximately 100 ft of the vibration source, although there are examples of ground-borne vibration causing interference out to distances greater than 200 ft. When roadways are smooth, vibration from traffic, even heavy trucks, is rarely perceptible. For most projects, it is assumed that the roadway surface will be smooth enough that ground-borne vibration from street traffic will not exceed the impact criteria; however, construction of the project could result in ground-borne vibration that could be perceptible and annoying.

Ground-borne vibration has the potential to disturb people as well as damage buildings. Ground-borne vibration is usually measured in terms of vibration velocity, either the root-mean-square (RMS) velocity or peak particle velocity (PPV). RMS is best for characterizing human response to building vibration, and PPV is used to characterize the potential for damage. Decibel notation acts to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as:

$$Lv = 20 \log10 [V/Vref]$$

Where Lv is the velocity in decibels (VdB), “V” is the RMS velocity amplitude, and “Vref” is the reference velocity amplitude, or 1x10-6 inches per second used in the United States.

Factors that influence ground-borne vibration and noise include the following:

- **Vibration Source**: Vehicle suspension, wheel types and condition, track/roadway surface, track support system, speed, transit structure, and depth of vibration source
- **Vibration Path:** Soil type, rock layers, soil layering, depth to water table, and frost depth
- **Vibration Receiver:** Foundation type, building construction, and acoustical absorption

Among the factors listed above, there are significant differences in the vibration characteristics when the source is underground compared to at the ground surface. In addition, soil conditions are known to have a strong influence on the levels of ground-borne vibration. Among the most important factors are the stiffness and internal damping of the soil and the depth to bedrock.

APPLICABLE NOISE STANDARDS

The County, which owns, operates, and manages the landfill, regulates noise based on the criteria presented in the Noise Element[2] of the General Plan as well as the Zoning Ordinance[3].

County of Lake Noise Element

The goal of the Lake County General Plan Noise Element is "to protect County residents from the harmful exposure of excessive noise and prevent incompatible land uses from encroaching upon existing and planned land uses".

Additionally, Policy N-1.7 of the Noise Element, Noise Controls During Construction, states that "The County shall require contractors to implement noise-reducing mitigation measures during construction when residential uses or other sensitive receptors are located within 500 feet."

County of Lake Zoning Ordinance

Article 41, Section 21-41.11 of the County's Zoning Ordinance establishes maximum sound emissions that shall not be exceeded based on the zoning of the receiving property. Table A presents the A-weighted hourly noise level standards which would be applicable at the neighboring property lines to the project site.

Table A: Hourly Noise Level Standards (dBA L_{eq})

Receiving Property Zoning District	Time Interval	Hourly Noise Level (dBA)
Residential	10:00 p.m. to 7:00 a.m.	45
	7:00 a.m. to 10:00 p.m.	55
Commercial	10:00 p.m. to 7:00 a.m.	55
	7:00 a.m. to 10:00 p.m.	60
Industrial	10:00 p.m. to 7:00 a.m.	60
	7:00 a.m. to 10:00 p.m.	65

Source: Lake County Zoning Ordinance (Lake County 2014).

The County's Zoning Code also provides a list of situations and sources which are exempt from the hourly noise standards presented in Table A which includes construction site sounds between 7:00 a.m. and 7:00 p.m.

Federal Transit Administration

Because the County does not establish construction noise thresholds, for the purposes of analyzing significance under CEQA, the Federal Transit Administration (FTA) Manual[4] criteria are used. The FTA provides reasonable criteria for assessing construction noise impacts based on the potential for

[2] County of Lake. 2008. *General Plan Noise Element.* September.
[3] County of Lake. 2014. *Lake County Zoning Ordinance Article 41.*
[4] Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual. Office of Planning and Environment. Report No. 0123. September.

adverse community reaction when the noise criteria are exceeded. For residential uses, the daytime noise threshold is 80 dBA L_{eq}.

Additionally, the County's Noise Element and Zoning Ordinance do not provide specific vibration impact criteria associated with construction activities; therefore, the FTA criteria will be used in this analysis.

The criteria for potential building damage from ground-borne vibration and noise are based on the maximum levels for a single event. Table B lists the potential vibration building damage criteria associated with construction activities, as suggested in the FTA Manual. FTA guidelines show that a vibration level of up to 0.5 in/sec PPV is considered safe for buildings consisting of reinforced concrete, steel, or timber (no plaster), and would not result in any construction vibration damage. For a non-engineered (those not designed by an engineer or architect) timber and masonry building, the construction building vibration damage criterion is 0.2 in/sec PPV.

Table B: Construction Vibration Damage Criteria

Building Category	PPV (in/sec)
Reinforced concrete, steel, or timber (no plaster)	0.50
Engineered concrete and masonry (no plaster)	0.30
Non-engineered timber and masonry	0.20
Buildings extremely susceptible to vibration damage	0.12

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
in/sec = inches per second PPV = peak particle velocity

THRESHOLDS OF SIGNIFICANCE

A project would normally have a significant effect on the environment related to noise if it would substantially increase the ambient noise levels for adjoining areas or conflict with the adopted environmental plans and the goals of the community in which the project is located. The applicable noise standards governing the project site are the criteria in the Noise Element of the County's General Plan and the County's Zoning Ordinance. Typically, the following criteria are used to determine when a project results in a significant noise or vibration impact:

- For off-site transportation-related impacts:
    - Where the project-related permanent increase in ambient noise levels of 3 dBA CNEL or greater occurs.
- For non-transportation-related stationary source impacts, including daily waste receipt, compaction and cover placement operations at the project site:
    - If existing noise levels experienced due to operations at the project site are less than the hourly daytime noise level standard of 55 dBA L_{eq}, then an exceedance of the standards listed in Table A would constitute a potentially significant impact.

  - If existing noise levels experienced due to operations at the project site are greater than the hourly daytime noise level standard of 55 dBA L_{eq}, then a perceptible increase of 3 dBA or more would constitute a potentially significant impact.

- For construction-related noise impacts:
  - If construction activities do not comply with the stated construction hours in the Zoning Ordinance or exceed the 80 dBA L_{eq} FTA standard for residential uses.
- For construction-related vibration impacts:
  - If vibration impacts exceed the FTA impact criteria listed above in Table B.

EXISTING NOISE ENVIRONMENT

The project site is surrounded by existing single-family homes to the west and south, an existing composting facility to the north, and vacant land to east. In order to assess the existing noise environment surrounding the project site, two long-term noise measurements were gathered. The long-term 24-hour measurements were taken from June 26, 2019, to June 27, 2019. The locations of the noise measurements are shown on Figure 4, with the results shown in Table C. A review of the data gathered indicates that existing noise levels at the nearest residential uses, the single-family home near 36th Avenue and Parker Avenue, range from 44.2 to 54.8 dBA L_{eq}. Noise levels in the area of the existing measurement locations are greatly affected be traffic on local unfinished, dirt roads, and birds. In addition to the noise levels data gathered, weather information, specifically winds speeds, was reviewed. Though it was indicated that wind speeds in excess of 10 mile per hour occurred from 12:00 p.m. to approximately 6:00 p.m. on June 26th, resulting in potentially higher than usual noise levels, noise levels still remained below the County's hourly noise levels standard of 55 dBA L_{eq} during daytime hours.

The neighboring sensitive receptors are all located west and south of the project site. The closest residential structure is located approximately 400 feet southwest of the limit of work for landfill expansion Phase 2 construction, while the residential uses to the west along Konocti Avenue are approximately 1,200 feet from the edge of the project site.

In addition to the noise level measurements at the surrounding sensitive uses, LSA gathered reference noise level measurements for existing operations on June 26, 2019, to identify the specific noise impacts associated with each piece of equipment used in daily operations. Table D provides a summary of those measurements.

Table C: Long-Term 24-hour Noise Level Measurements

Location	Daytime Noise Levels[1] (dBA L_{eq})	Evening Noise Levels[2] (dBA L_{eq})	Nighttime Noise Levels[3] (dBA L_{eq})	Average Daily Noise Level (dBA CNEL)
LT-1: Near the closest residence south of the landfill at the intersection of 36th Avenue and Parker Avenue	44.2 – 54.8	45.2 – 48.0	37.1 – 48.2	51.3
LT-2: Near the closest residence west of the landfill at the intersection of 42nd Avenue and Konocti Avenue	40.3 – 51.4	42.4 – 47.3	36.9 – 45.4	48.1

Source: Compiled by LSA (2019).
[1] Daytime Noise Levels = noise levels during the hours of 7:00 a.m. to 7:00 p.m.
[2] Evening Noise Levels = noise levels during the hours of 7:00 p.m. to 10:00 p.m.
[3] Nighttime Noise Levels = noise levels during the hours of 10:00 p.m. to 7:00 a.m.
dBA = A-weighted decibels
CNEL = Community Noise Equivalent Level
L_{eq}=equivalent continuous sound level

Table D: Reference Noise Levels of Equipment Used at the Landfill for Daily Operations

Equipment	Average Noise Level at 50 feet (dBA L_{eq})	Notes
Water Truck	80.2	Pass-bys occur as needed during daily operations
Loader	80.2	973C – dominate source of noise during a typical hour of activity
Compactor	61.9	826K – Studded wheels used to press trash
Scraper	75.5	623G – Used to move dirt for areas of cover
Rock Crusher	75.3	RM 100GO! – Utilized to process excavated materials

Source: Compiled by LSA (2019).
dBA = A-weighted decibels
L_{eq}=equivalent continuous sound level

IMPACT ASSESSMENT

This section includes analysis of environmental parameters based on Appendix G of the *State CEQA Guidelines*. The discussion not only includes the areas for which there is potential for environmental impacts but also provides justification for the conclusions that either no impacts, less-than-significant impacts, or less-than-significant impacts with mitigation could occur. The CEQA Analysis Checklist questions and the environmental significance conclusion appear under each environmental parameter, followed by a discussion supporting each conclusion.

XII: NOISE	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
Would the project:				
(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
(b) Generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐
(c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

Discussion

This section analyzes the short-term noise and vibration impacts associated with construction activities as well as the long-term operational noise impacts that may result due to development of the proposed project.

Impact Analysis

a. Would the project generate a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ozrdinance, or applicable standards of other agencies?

Standards and ordinances applicable to the proposed project would be associated with day-to-day landfill operations, new cell construction, long-term traffic, and stationary noise. The proposed project consists of construction activities and operations over the course of four expansion phases

Construction Noise Impacts

As presented under the local noise standards, the threshold used for determining significance related to construction noise is compliance with Article 41, Section 21-41.11 of the County's Zoning Code and the FTA criteria.

As stated above in the project description, Phase 2 of the landfill expansion will be the most intensive with respect to heavy equipment and staffing needs. Based on information provided in the Estimated Heavy Equipment Use Memorandum, the following is a list of construction equipment expected to be in use during the overlap of Phase 2 soil excavation and the bottom liner installation:

Soil Excavation:

- Excavator: Two (2) CAT 330 with 5 foot bucket
- Haul Truck: Six (6) CAT 752C2
- Dozer: Three (3) CAT D6 or D8
- Water Truck: Two (2) Freightliner

Bottom Liner Installation:

- Excavator: One (1) CAT 330 with 5 foot bucket
- Haul Truck: Two (2) CAT 752C2
- Telehandler: One (1) Bobcat V519
- Utility Vehicle: One (1) Bobcat 3400

Typical operating cycles for these types of construction equipment may involve 1 or 2 minutes of full-power operation followed by 3 or 4 minutes at lower power settings.

Table E lists typical construction equipment noise levels recommended for noise impact assessments, based on a distance of 50 ft between the equipment and a noise receptor, taken from the FHWA Roadway Construction Noise Model[5]. Based on the information in Table E, the maximum noise level generated by each piece of equipment is logarithmically added in order to determine a composite maximum noise level.

In order to calculate the noise levels expected to result from short-term construction and long-term operational stationary source activities, the software SoundPLAN was used. SoundPLAN is a noise modeling program that allows 3-D calculations to be made taking into account topography, ground attenuation, and shielding from structures and walls. Within the model, the noise library allows for the input of many noise sources and calculates the composite noise levels experienced at any receptor necessary. The results from any calculation can be presented both in both tabular and graphic formats.

In SoundPLAN, the composite activity is modeled as an area source that is representative of an area in which the equipment is likely to work within a given hour. The usage factors from Table E are incorporated to produce a composite noise level for the duration of an hour so an hourly L_{eq} can be determined at the surrounding sensitive receptors dependent on the location of construction activities. In order to assess the greatest expected construction noise levels experienced during construction at the nearest residential uses surrounding the project site, a model run was

[5] Federal Highway Administration (FHWA). 2006. Highway Construction Noise Handbook. Roadway Construction Noise Model, FHWA-HEP-06-015. DOT-VNTSC-FHWA-06-02. NTIS No. PB2006-109012. August.

completed that assumes the construction activities would occur simultaneously at the southernmost portion of Phase 2.

Table E: Typical Maximum Construction Equipment Noise Levels (L_{max})

Type of Equipment	Acoustical Usage Factor	Suggested Maximum Sound Levels for Analysis (dBA L_{max} at 50 ft)
Air Compressor	40	80
Backhoe	40	80
Cement Mixer	50	80
Concrete/Industrial Saw	20	90
Crane	16	85
Excavator	40	85
Forklift	40	85
Generator	50	82
Grader	40	85
Loader	40	80
Paver	50	85
Roller	20	85
Rubber Tire Dozer	40	85
Scraper	40	85
Tractor	40	84
Truck	40	84
Welder	40	73

Source: Roadway Construction Noise Model (FHWA 2006).
dBA = A-weighted decibels
ft = feet
L_{max} = maximum noise level

Figure 5 shows the locations for which modeling of potential construction noise impacts were performed.

As stated above, according to the Zoning Code, construction activities are limited to the hours between 7:00 a.m. and 7:00 p.m. Compliance with the zoning code hours would ensure that construction noise does not disturb residents during the times they are most likely to be home or during hours when ambient noise levels are likely to be lower (i.e., at night).

As stated above, the FTA's daytime construction noise criteria or threshold for residential uses is 80 dBA L_{eq} for an 8-hour period. For the purposes of this analysis, it was assumed that the modeled hourly noise level could occur for multiple consecutive hours and possibly over an 8-hour period. Therefore, the modeled hourly noise levels could be equivalent to an 8-hour L_{eq}.

As shown on Figure 5 construction noise levels would approach 67.7 dBA L_{eq} and would not exceed the FTA hourly noise level standard at the closest noise sensitive use. Consistent with Policy N-1.7 of the General Plan, when construction activities occur within 500 feet of the nearest residences, the following noise reduction practices are required:

- Prior to issuance of permits, the Lake County General Manager, or designee, (or its contractor), shall verify that grading and construction plans include the following requirements:
    - Construction equipment, fixed or mobile, shall be equipped with properly operating and maintained noise mufflers consistent with manufacturer's standards.
    - Construction staging areas shall be located away from off-site sensitive uses during the later phases of project development.
    - The project contractor shall place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site whenever feasible.
- With the incorporation of the above noise reduction measures and compliance with the County's hours of allowed construction, construction noise impacts would be less than significant.

Long-Term Off-Site Traffic Noise Impacts

In order to assess the potential traffic impacts related to the landfill expansion, LSA prepared a Transportation Memorandum[6] for the proposed project. Based on the analysis results, it was determined that up to an additional 20 passenger vehicle trips and 26 large truck trips per day would be generated by the project.

As presented in the Transportation Memorandum, the existing ADT along Davis Street east of Phillips Avenue is approximately 780. Due to the existing low traffic volume, this segment has the potential to experience the greatest effect due to traffic noise increases. The following equation was used to determine potential impacts:

$$\text{Change in CNEL} = 10 \log_{10} [V_{e+ht}/V_{existing}]$$

Where: $V_{existing}$ = the existing daily volume
V_{e+ht} = existing daily volumes plus project
Change in CNEL = the increase in noise level due to the project

The results of the calculations show that an increase of approximately 0.4 dBA CNEL (Community Noise Equivalent Level measured in A-weighted decibels) is expected. A noise level increase of less than 1 dBA would not be perceptible to the human ear. The noise increase on all other roadway segments which additional traffic has the potential to occur would be less than 0.4 dBA CNEL. Therefore, noise impacts related to operational traffic would be less than significant.

Long-Term Landfill Operations Noise Impacts

It order to ensure that the goals of the Noise Element are achieved, noise level standards provided in the County's Zoning Ordinance will be utilized to determine potential impacts. As part of the proposed project, the existing on-site noise generation for day-to-day landfill operations would be relocated, dependent on phase, and would likely cause an increase in noise generated to surrounding sensitive uses. Figures 6 and 7 show the locations of the sources today assuming a

[6] LSA. 2019. *Transportation Memorandum for the Eastlake Sanitary Landfill Expansion Project*. October.

"busy day" and sources during Phase 2 assuming a "busy day", respectively. The term "busy day" refers to the condition as dictated by landfill operations staff that occurs one to two times per week when a there is a peak in waste deliveries and requires a greater amount of heavy equipment use throughout the day as compared to typical days (this is common at landfill sites depending on customer deliveries, commercial activity and other factors). The existing and proposed operations are conservative in nature (i.e., all operations that would occur during a typical day are occurring simultaneously). Given that the analysis assumes that all equipment would be operating simultaneously, it was determined that the best metric to identify typical increases in the noise environment is the hourly average noise level (L_{eq}). While maximum noise levels for each piece of equipment may be higher than the L_{eq}, it is unlikely that the maximum noise level for all pieces of equipment operating on site would occur simultaneously. In order to assess the potential noise levels created by the existing and future operations at the project site, a variety of reference noise levels were gathered. The results of the reference measurements are presented in Table D. In order to model the potential noise impact when all sources are operating simultaneously, the sound-pressure levels associated with each piece of equipment are converted to A-weighted sound power levels (LwA). The noise sources measured and their respective sound power level included in the analysis represent the loudest daytime noise hour when the greatest amount of equipment is in operation.

A description of the sources measured and their respective sound power level included in the analysis, which represent the loudest daytime noise hour when the greatest amount of equipment is in operation, is as follows:

- **Water Truck**: This piece of equipment is used to suppress dust throughout the project site and is used near daily operations as well. The sound-power level for this piece of equipment is 114.8 LwA.

- **Loader**: This piece of equipment is used to move waste once dumped in an active area, generally to spread around and remove piles from forming. The sound-power level for this piece of equipment is 114.9 LwA.

- **Compactor**: This piece of equipment is used to densify waste once dumped at the active work face area, generally to flatten bulky items or piles of waste. The sound-power level for this piece of equipment is 94.6 LwA.

- **Scraper**: This piece of equipment is used to gather soil on-site and relocated to another part of the site. Typically, this activity occurs when soil is being placed over waste as daily cover. The sound-power level for this piece of equipment is 110.2 LwA.

- **Rock Crusher**: This piece of equipment is used to crush larger pieces of large rock or hard material into smaller pieces such that the resulting material can be used for various applications. The sound-power level for this piece of equipment is 109.9 LwA.

For the existing operations condition on a busy day, as shown in Figure 6, it is assumed that two loaders, two compactors, two scrapers and water truck would be in use near the northwest portion of the project site were the existing open cell is located. Additionally, the rock crusher operations

and associated scraper activities would occur near the existing retention pond on the southern portion of the project site. To model a condition that would produce the loudest noise levels to the nearest existing receptor for future conditions, as shown in Figure 7, it is assumed that two loaders, two compactors, two scrapers and water truck would be in use in the Phase 2 expansion area in the southern portion of the project site.

While Figures 6 and 7 show a graphic representation of the noise contours generated by landfill operation under each condition, Table F shows the results of the noise modeling for existing and future operations.

Table F: Comparison of Daily Operations Contributions
Loudest Modeled Hour (dBA L_{eq})

Receiver Location	Existing Noise Level (dBA L_{eq})	Phase 2 Operations Noise Level (dBA L_{eq})
R1: Near the closest residence south of the landfill at the intersection of 36th Avenue and Parker Avenue	45.0	52.1
R2: Near the closest residence southwest of the landfill between 37th and 38th Avenues, east of Konocti Avenue	44.0	48.4
R3 - Near the closest residence west of the landfill at the intersection of 42nd Avenue and Konocti Avenue	41.3	34.0

Source: Compiled by LSA (2019).
dBA = A-weighted decibels
L_{eq}=equivalent continuous sound level

The results show that noise levels generated by landfill operation at all of the receivers would remain below the County's Zoning Code exterior noise standard of 55 dBA L_{eq} in both the existing and future conditions. Additionally, it shall be noted that noise levels generated by landfill operations for future conditions would be less than existing noise levels based on measurements gathered and presented in Table C. The existing data suggests that existing noise levels at the surrounding receptors/uses are affected greatly by local traffic on unfinished, uneven dirt roads and periodic high winds. Therefore, no significant noise impacts would occur, and no mitigation is required.

b. Would the project generate excessive groundborne vibration or groundborne noise levels?

Heavy equipment operation during construction as well as typical daily landfill activities can generate varying degrees of ground-borne vibration depending on the procedures and the equipment used. The operation of heavy equipment generates vibrations that spread through the ground and diminish in amplitude with distance from the source. The effect on buildings located in the vicinity of the operations often varies depending on soil type, ground strata, and construction characteristics of the receptor buildings. The results from ground-borne vibration can range from no perceptible effects at the lowest ground-borne vibration levels to low rumbling sounds and perceptible ground-borne vibration at moderate levels, to slight damage at the highest levels.

Ground-borne vibration from heavy equipment activities rarely reaches the levels that damage structures.

The greatest levels of vibration are anticipated to occur with the operations of heavy equipment such as dozers and scrapers, which are expected to generate levels similar to a large bulldozer. All other equipment are expected to result in lower vibration levels. As shown in Table G, bulldozers and other heavy-tracked construction equipment generate approximately 0.089 in/sec PPV of ground-borne vibration when measured at 25 ft.

Table G: Vibration Source Amplitudes for Heavy Equipment

Equipment	Reference at 25 ft PPV (in/sec)
Hoe Ram	0.089
Large Bulldozer	0.089
Caisson Drilling	0.089
Loaded Trucks	0.076
Jackhammer	0.035
Small Bulldozer	0.003

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
ft = feet
in/sec = inches per second
PPV = peak particle velocity

The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the project boundary (assuming the heavy equipment would be used at or near the project boundary) because vibration impacts occur normally within the buildings. The formula for vibration transmission is provided below.

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

With the vibration attenuation through distance divergence at 400 ft, vibration levels would be reduced to less than 0.001 in/sec PPV or less. This level is below the FTA's criteria for the most sensitive buildings (0.12 in/sec PPV); therefore, vibration levels from heavy equipment operations would not have the potential to cause vibration damage at the nearest structures, and no mitigation is required.

c. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

The project site is not located within 2 miles of any airport, airport land use plan or private airstrip. The closest airport is Lampson Field Airport located 15.6 miles west of the project site. Therefore, the project would not expose people residing or working in the project area to excessive noise levels.

Attachments: Figures 1–7
Long-Term Noise Monitoring Results